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ENVIRONMENT DIRECTORATE
CHEMICALS AND BIOTECHNOLOGY COMMITTEE

Working Party on Exposure Assessment

EMISSION SCENARIO DOCUMENT ON FLUOROCARBON SUBSTITUTES: MANUFACTURE OF RIGID AND FLEXIBLE FOAM VIA FOAM BLOWING. SCOPING DOCUMENT.

Series on Emission Scenario Documents
No. 41

June 2021

ACTION REQUIRED: The Working Party on Exposure Assessment is invited to discuss and provide comments on this document by 16 August 2021.

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JT03478803

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Figures

[TOC \h \z \c "Figure"]

1. Introduction

The U.S. Environmental Protection Agency (EPA) with support from Eastern Research Group, Inc. (ERG) has developed this draft scoping document for an Emission Scenario Document (ESD) to estimate environmental releases and occupational exposures from fluorocarbon substitutes in the manufacturing of rigid and flexible foam by foam blowing. The document is being distributed to Organization for Economic Co-operation and Development (OECD) member countries to solicit input and data for the development of an ESD on these chemicals. The following document provides an overview of the manufacturing of foams using fluorocarbon substitutes and presents the proposed scope for a relevant ESD.

1.1 Purpose

OECD ESDs provide estimates of environmental releases or occupational exposures from standard release sources (e.g., equipment cleaning) and worker activities (e.g., unloading). The first step in preparing an ESD is clearly identifying the scope or industry/chemical sector that will be investigated to ensure a useful and manageable document is developed. This document presents a proposed scope for an ESD covering the foam blowing use (e.g., rigid foam, flexible foam) of fluorocarbons substitutes. To determine the scope, EPA reviewed readily available data[1] to clearly identify the operations and chemicals that may be utilized within the foam manufacturing industry sector. Pre-manufacture Notice (PMN) submissions (from EPA's new chemicals review program) were reviewed to capture any specific information provided by facilities related to environmental releases and occupational exposures from foam manufacturing.

1.2 Proposal Summary

Based on readily available information, fluorocarbon substitutes are typically manufactured or imported as volatile liquids or gases (PEI, 1990). However, most fluorocarbon substitutes have vapor pressures that are significantly higher than the upper recommended bound for default EPA/OPPT vapor generation models (U.S. EPA, 2013). Additionally, most PMN submissions reviewed provide a general description of end use, but do not provide detailed information to perform an environmental release and occupational exposure assessment.

EPA previously developed two generic scenarios (GSs) relevant to this ESD, the 1991 Chlorofluorocarbon (CFC) Substitutes GS and 1991 Foam Blowing GS, which cover CFCs and their substitutes used in foam blowing. EPA also developed two industry profiles, one on the rigid polyurethane foam industry and one on the flexible polyurethane foam industry (U.S. EPA, 2004a-b). There are two main literature reports relevant to this ESD, including the 1990 *Occupational Exposure and Environmental Release Data for Chlorofluorocarbons (CFCs) and Their Substitutes* (PEI, 1990) and the 1990 *Hydrocarbons and Hydrochlorofluorocarbons Interim Report* (U.S. EPA, 1990). In 2018, EPA drafted a report summarizing the baseline values presented in these 1990 reports, titled

[1] See Appendix A for a list of sources investigated.

Manufacturing and Foam Blowing Use of Fluorocarbon Substitutes – Baseline for Premanufacture Notice (PMN) Estimates per 1990 Methodology (hereafter referred to as "Group 1 Baseline Report").

Based on release and exposure points identified in the development of the Group 1 Baseline Report and the literature search performed for this scoping document, the ESD would focus on environmental releases of and occupational exposures to fluorocarbon substitutes during the manufacturing of rigid and flexible foam by foam blowing. The following diagram demonstrates the proposed scope in the dashed box ([REF _Ref72762217]).

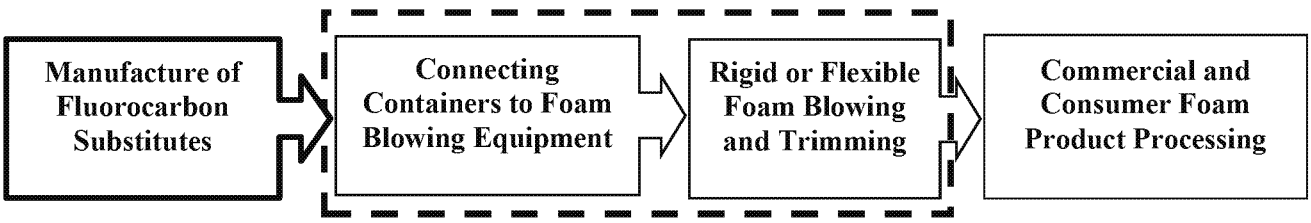


Figure [STYLEREF 1 \s]-[SEQ Figure * ARABIC \s 1]: Proposed Scope of ESD on Fluorocarbon Substitutes: Manufacture of Rigid and Flexible Foam via Foam Blowing

2.0 Industry Background and Process Summary

2.1 Industry background

EPA has compiled industry information from the 2019 NAICS survey to provide a general summary of fluorocarbon substitutes use in foam blowing applications. The following 6-digit NAICS codes include facilities at which fluorocarbon substitutes are used in foam manufacturing:

- 326140 – Polystyrene Foam Product Manufacturing
- 326150 – Urethane and Other Foam Product (except Polystyrene) Manufacturing

Using the information collected by the U.S. Census Bureau, [REF _Ref55824066 \h * MERGEFORMAT] presents the number of establishments and employees that reported for the identified NAICS codes in 2019.

Table 2-[SEQ Table * ARABIC]. Number of Establishments and Employees Throughout the U.S. in 2019

NAICS	NAICS Description	Number of Establishments	Number of Employees
326140	Polystyrene Foam Product Manufacturing	430	27,028
326150	Urethane and Other Foam Product (except Polystyrene) Manufacturing	674	32,028
	Total	1,104	59,056

Based on information reported in 2019 to the U.S. Census Bureau for the applicable NAICS codes, the number of establishments that use fluorocarbon substitutes in foam manufacturing is over 1,000 and the number of employees is almost 60,000.

The volume of CFCs used in 1985 was 55.6 million kilograms for rigid foams and 3.2 million kilograms for flexible molded foams (U.S. EPA, 1991a). The composition of CFCs in foam was found to be 5 to 14% (PEI, 1990). A more current estimate of the use rate and chemical compositions of CFCs or CFC substitutes were not found during the searches conducted for this scoping document. These data will be collected in subsequent data collection efforts and included in the ESD.

Some key uncertainties in the currently available data include facility throughput data, estimation methods for exposure and releases, the impact of engineering and administrative controls on occupational exposures, and whether a 100% release scenario can be implemented during foam blowing. These uncertainties are further discussed in Section [REF _Ref75264209 \r \h].

2.2 Process Summary

Fluorocarbons are used as blowing agents in the manufacture of rigid and flexible foams, typically polyurethane (PUR). Other foam types include phenolic, polypropylene, polyethylene, polyvinyl chloride, and polystyrene. These foams are used in a wide variety of applications including refrigerators, buildings, automobiles, furniture, packaging, etc. The blowing agent is used to propel liquid plastic resin and, in the case of foam used for insulation, functions as an insulating component of the foam. Specific applications are listed below (U.S. EPA, 2014):

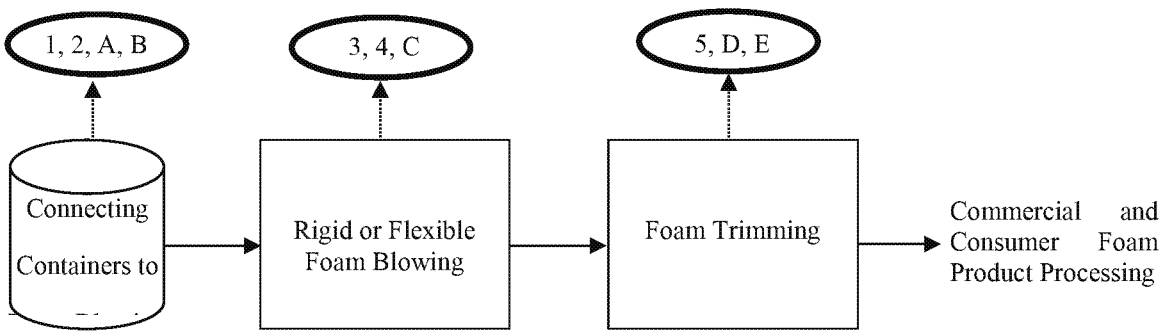
- Rigid Polyurethane Appliance Foam – insulation foam in domestic refrigerators and freezers.
- Rigid Polyurethane Spray, Commercial Refrigeration, and Sandwich Panels – insulation for roofing, wall, pipes, metal doors, vending machines, coolers, buoyancy, and refrigerated transport vehicles.
- Flexible Polyurethane – foam furniture, bedding, chair cushions, and shoe soles.
- Integral Skin Polyurethane – car steering wheels, dashboards and shoe soles.
- Polystyrene Extruded Sheet – foam for packaging and buoyancy or floatation.
- Polyolefin – foam sheets and tubes.
- Rigid Polyurethane Slabstock and Other – insulation for panels and pipes.
- Polystyrene Extruded Boardstock & Billet – insulation for roofing, walls, flooring, and pipes.
- Rigid Polyurethane & Polyisocyanurate Laminated Boardstock – insulation for roofing and walls.
- Phenolic Insulation Board & Bunstock – insulation for roofing and walls.

During the foam blowing process, the fluorocarbon or substitute is first blended with polyol, isocyanate, and other materials in a mixing head. Soon after leaving the mix head, the raw materials begin to create foam producing reactions, producing the polyurethane foam on a conveyor. Most foam manufacturers have computerized controls at the mix head that allow the raw materials mixture to be changed to achieve the desired characteristics of the end product. After 5 to 10 minutes, polymerization reactions are complete enough for the foam to be handled and cut. Each cut of foam is removed from the conveyor and moved to a curing area (U.S. EPA, 2004a-b).

Most blowing agents produce foam expansion through the boiling of the blowing agent within the foam. The gases produced from the boiling expand the foam, forming cells within the foam network. However, some blowing agents cause expansion through the formation of gases upon reaction (U.S. EPA, 2018). In both types of foam, fluorocarbon substitutes do not serve a purpose after foam blowing is completed.

Fluorocarbons can be released from formulation/mixing of foam ingredients, from the dispensing head during foam blowing, and during cutting/trimming of the foam. In flexible PUR foams, the blowing agent is completely released during foam blowing or shortly thereafter (U.S. EPA, 1991b). In rigid PUR foams, fluorocarbons are trapped inside the closed foam cells during foam blowing, resulting in a small amount of fluorocarbon lost to air (U.S. EPA, 2004b). Data to estimate releases and exposures are available in the CFC reports referenced in Section [REF _Ref448921368 \n \h] (PEI, 1990; U.S. EPA, 1990; U.S. EPA, 1991a-b). However, searches for more current data will be conducted in subsequent data collection efforts for this ESD.

Based on the above discussion, the scope of the ESD should focus on the release and exposure points shown in [REF _Ref75262134 \h], during the use of fluorocarbon substitutes in rigid and flexible foam manufacturing via foam blowing.



Environmental Releases:

1. Release to air from connecting container to foam blowing equipment
2. Release to uncertain media from transport container disposal
3. Release to air during foam blowing
4. Release to uncertain media from equipment cleaning
5. Release to landfill or incineration from foam trimming

Occupational Exposure:

Figure 2-[SEQ Figure * ARABIC \s 1]. Release and Exposure Points Within Scope

3.0 PMN Database Search

EPA maintains a database of the functions and uses of chemicals reviewed under the PMN program. EPA previously conducted a search of chemicals received from January 1992 through July 2018 to help identify and narrow the scope of the ESD. The results of this search are presented below in this section. EPA did not conduct search of more recent chemical submissions at this time.

A total of 34 submissions were identified from 18 different companies, using the following keywords: "*cfc*"; "*fluorocarbon*"; "*fluor*" and "*substitute*"; "*fluor*" and "*replac*"; "*blowing*"; "*rigid*" and "*foam*"; "*flex*" and "*foam*"; "*urethan*" and "*foam*". EPA completes Initial Review Engineering Reports (IRERs) based on PMN submissions to estimate environmental releases and occupational exposures of the chemical from manufacturing through use. ERG reviewed the IRER reports for the most recent 15 cases (all cases since 2000). Key findings from the review are presented as follows:

- All chemicals were volatile liquids (VP > 0.01 torr);
- 11 of the 15 chemicals had vapor pressures greater than 35 torr;
- 7 of the 15 were related to foam blowing uses;
- 13 of the 15 chemicals were manufactured domestically;
- 10 of the 15 chemicals were processed domestically (repackaging, purification, blending);
- For releases during use, 4 of the assessments used standard models, 3 assessments referenced the 1990 PEI report, 2 referenced the 1991 CFC Substitutes GS, 5 used submitter estimates, and 1 referenced the Use of Vapor Degreasers ESD.
- For exposures during use, 6 referenced standard models, 2 referenced the 1990 PEI report, 4 referenced the 1991 CFC Substitutes GS, 2 used submission estimates, and 1 referenced Use of Vapor Degreasers ESD.
- 7 of the 15 cases required additional review or standard review.
- Generally, detailed release and inhalation exposure data were not provided in the submissions.

In summary, typical processing operations included repackaging, additional fractionation/purification, and blending. Submissions typically provided the number of sites for manufacturing and/or processing but did not provide information to generate release and exposure estimates. Submissions generally also described general end uses, but did not provide detailed generally facility parameters, or release and exposure estimates. Additionally, the chemicals were manufactured or imported as highly volatile liquids (VP > 100 torr), which cannot be accurately assessed with standard EPA/OPPT air release and inhalation exposure models. The EPA/OPPT models are only recommended to an upper vapor pressure range of 35 torr (U.S. EPA, 2013).

Additionally, there are inconsistencies in how inhalation exposures are assessed in the reviewed past cases. Many assessments used values from the 1991 CFC Substitutes GS while others referenced the 1990 PEI report. There are also inconsistencies in how air releases are assessed. Many

assessments reference the 1990 PEI report rather than the 1991 CFC Substitutes GS. While referencing the 1990 PEI report, assessments either cited the percent release to air provided within the text or estimated releases from daily emission rates provided in summary tables (based on 1988 Toxics Release Inventory (TRI) data).

Based on the PMN search, this ESD should provide specific guidance on selecting the most appropriate methodology for assessing air releases and inhalation exposures. In addition, the ESD should address how to select analogous or modeled data for assessing a chemical of interest, including any adjustments for vapor pressure or percent concentration. The ESD should also address how to estimate short term exposures from 8-hour TWA data.

4.0 Existing Chemicals Search

Under the Toxic Substances Control Act (TSCA), EPA evaluates the safety of existing chemicals through prioritization, risk evaluation, and risk management. During risk evaluation, EPA determines applicable conditions of use for each identified chemical, completes a systematic review of available information, and assesses presented occupational exposures and environmental releases for each condition of use. ERG compiled the conditions of use for the first and second rounds of existing chemicals undergoing risk evaluation with foam manufacturing in scope:

- First group of existing chemicals:
    - Hexabromocyclododecane (HBCD) – used as a flame retardant in expanded and extruded polyurethane foam manufacturing.
    - 1,4-Dioxane – used in spray polyurethane foam.
    - Methylene Chloride – used in flexible polyurethane foam manufacturing.
    - Trichloroethylene – used as a foam blowing agent in flexible and rigid polyurethane foam.
- Second group of existing chemicals:
    - Trans-1,2-Dichloroethylene – used as a blowing agent in flexible polyurethane foam manufacturing.
    - Triphenyl Phosphate (TPP) – used as a flame retardant in the manufacture of spray polyurethane foam.
    - Tris(2-chloroethyl) Phosphate (TCEP) – used as a flame retardant in the manufacture of flexible and rigid polyurethane foams.
    - Formaldehyde – used in urethane foam manufacturing.

For the first group of existing chemicals, ERG reviewed the assessment approaches in the final risk evaluations for chemicals with foam manufacturing conditions of use. The risk evaluation for HBCD did not assess foam blowing but assessed plastic compounding and converting for the production of expanded and extruded polyurethane foam. The risk evaluation for 1,4-Dioxane also did not assess foam blowing but assessed the application of spray polyurethane foam insulation. The risk evaluation for methylene chloride assessed foam blowing in flexible polyurethane foam manufacturing. The risk evaluation for trichloroethylene assessed use as an intermediate for foam blowing agents in polyurethane foam manufacturing. The round two existing chemicals have not yet undergone risk evaluation; however, trans-1, 2-dichloroethylene, TPP, TCEP, and formaldehyde all appear to have foam manufacturing processes within the scope of this ESD.

5.0 Proposed Scope

This section presents a more detailed analysis of the proposed scope presented in Section [REF _Ref448921368 \r \h * MERGEFORMAT]. Conclusions made based on the industry sector, the PMN database search, existing chemical conditions of use, and the literature search are presented below.

5.1 Scope Definition

Based on existing generic scenarios, the Group 1 Baseline Report, literature reviewed, and a review of past PMN cases, it is recommended that the ESD focus on the use of fluorocarbon substitutes in the manufacturing of rigid and flexible foams via foam blowing. The ESD would not cover other types of chemical additives used in foam nor other types of foam manufacturing processes because these are expected to result in different release and exposure potential. It is recommended that this ESD cover only environmental releases and occupational exposures of fluorocarbon substitutes during the foam blowing process and not during the subsequent life of the foam in various applications (e.g., refrigerator insulation, building insulation). The proposed ESD will include all potential release and exposure points during the foam blowing process.

5.2 Recommendation for Scenario Development

To develop the proposed ESD, existing literature and industry outreach (if necessary) will be used to construct quantitative estimates of general foam blowing facility throughput, environmental releases, and occupational exposures. Because fluorocarbon substitutes are highly volatile, it is expected that most releases will be to air, and most exposures will be through the inhalation route. However, there may be potential for other types of releases such as transport container residue and equipment cleaning. Additionally, there is the potential for dermal exposures to liquids; however, dermal exposures may be non-quantifiable depending on the volatility of the substance (the ESD will specify a specific vapor pressure at which dermal exposures are non-quantifiable). Additional research on these release and exposure points is necessary to determine their likelihood of occurrence and whether they should be included in the ESD. Section [REF _Ref73967387 \n \h] outlines areas of necessary research for development of the proposed ESD.

6.0 Sources Investigated and Necessary Research

For the development of this document, readily available sources were investigated. Phase 1 of the Literature Search in the *Generic Scenarios Development Process* (U.S. EPA, 2016) was completed. Appendix A presents the specific sources investigated. As the scenario is developed, scientific literature and other more specialized sources will be investigated as presented in Phase 2 of the Literature Search. Section 6.1 presents a summary of the key sources identified and a brief summary of the information in the sources. Section 6.2 presents key areas of research and data required to develop this scenario.

6.1 Sources Investigated

Generic Scenarios Development Process. August 2020. This document was used as a guide to complete the draft scoping document. It lists the necessary components and explains the procedure to develop a draft scoping document.

Occupational Exposure and Environmental Release Data for Chlorofluorocarbons (CFCs) and Their Substitutes. Revised Draft. November 1990. PEI Associates, Inc. This report provides general information on releases and exposures for the fluorocarbon substitutes.

Generic Scenario: CFC Substitutes. September 1991. This is the original scenario and provides background information and general information on releases and exposures

Generic Scenario: Polyurethane Foam Blowing. August 1991. This scenario provides general information on releases and exposures for the foam blowing use.

Generic Scenario: Application of Spray Polyurethane Foam Insulation. April 2021. This scenario provides background information on foam blowing processes and information on releases for the foam blowing use.

Industry Profile for the Flexible Polyurethane Foam Industry. February 2004. This document provides information on types of Fluorocarbon substitutes utilized in the flexible polyurethane foam blowing process and release information for these substitutes.

Industry Profile for the Rigid Polyurethane Foam Industry. September 2004. This document provides information on types of Fluorocarbon substitutes utilized in the rigid polyurethane foam blowing process and release information for these substitutes.

Determination of Comparative HCFC and HFC Emission Profiles for the Foam and Refrigeration Sectors Until 2015. July 2004. This joint report by ADEME and U.S. EPA provides release estimates and background information on HCFCs and HFCs used in foam blowing.

6.2 Necessary Research

In order to complete the proposed ESD updates, additional information is needed to fill certain data gaps. This data is critical to the estimation of conservative, but accurate release and exposure values during rigid and flexible foam manufacturing via foam blowing. The following are areas identified that require additional research:

- Updated industry information on number of sites, concentrations, and throughput information (general facility estimates).
- Updated information on potential release routes, engineering controls, and estimation methods for each operation.
- Information on the presence of fluorocarbon substitutes in finished foam products. This will help inform if a 100% release scenario can be assumed during foam blowing.
- Updated information on potential exposure points, monitoring data for fluorocarbon substitutes, personal protective equipment, and number of workers for each operation. Additionally, information to assist in the characterization of occupational exposures based on engineering and administrative controls.

7.0 References

(PEI, 1990) *Occupational Exposure and Environmental Release Data for Chlorofluorocarbons (CFCs) and Their Substitutes.* Revised Draft. PEI Associates, Inc. for U.S. Environmental Protection Agency. November 19, 1990.

(U.S. EPA and ADEME, 2004) *Determination of Comparative HCFC and HFC Emission Profiles for the Foam and Refrigeration Sectors Until 2015.* U.S. Environmental Protection Agency and French Environment and Energy Management Agency. July 2004.

(U.S. EPA, 1990) *Hydrocarbons and Hydrochlorofluorocarbons Interim Report.* U.S. Environmental Protection Agency. November 15, 1990.

(U.S. EPA, 1991a) *CFC Substitutes Generic Scenario.* U.S. Environmental Protection Agency. September 1991.

(U.S. EPA, 1991b) *Polyurethane Foam Blowing Generic Scenario.* U.S. Environmental Protection Agency. August 1991.

(U.S. EPA, 2004a) *Industry Profile for the Flexible Polyurethane Foam Industry.* U.S. Environmental Protection Agency. February 2004.

(U.S. EPA, 2004b) *Industry Profile for the Rigid Polyurethane Foam Industry.* U.S. Environmental Protection Agency. September 2004.

(U.S. EPA, 2013) Chemical Screening Tool for Exposures and Environmental Releases (ChemSTEER) version 3.0. U.S. Environmental Protection Agency. September 30, 2013. [HYPERLINK "http://www.epa.gov/opptintr/exposure/pubs/chemsteer.htm"]

(U.S. EPA, 2021) *Application of Spray Polyurethane Foam Insulation Generic Scenario.* U.S. Environmental Protection Agency. April 2021.

Appendix A: Literature Search Documentation

Generic Scenario Literature Search Documentation Table (March 2016 version)

Phase 1: Standard Literature Search

Researcher: Anna Dimling, Jess George

Phase 1 Completion Date: May 21, 2021

Primary Keywords: foam manufactur*, fluorocarbon substitut*, *CFC, foam blowing, blowing agent*, rigid foam, flexible foam, *urethane

Phase 1, Part 2: Search of Standard RAD Sources

Results
ng:
99009_voc_epa450_3-90-020_polystyrene_foam_manufacturing.pdf"]
gid Foam Manufacturing:
yActionD=ZyDocument&Client=EPA&Index=1986+Thru+1990&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFi xt%5C00000031%5C9101QPR9.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C- y=r75g8/r75g8/x150y150g16/i425&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x
Flexible Polyurethane Foam Manufacture:
yActionD=ZyDocument&Client=EPA&Index=1986+Thru+1990&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFi xt%5C00000011%5C2000TLSB.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C- y=r75g8/r75g8/x150y150g16/i425&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x

Phase 1, Part 2: Search of Standard RAD Sources

	Results
nission Control Options:	
ActionD=ZyDocument&Client=EPA&Index=1976+Thru+1980&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFie xt%5C00000022%5C910135ZP.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C- y=r75g8/r75g8/x150y150g16/i425&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x	
rt. External Review Draft:	
vActionD=ZyDocument&Client=EPA&Index=1986+Thru+1990&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFi xt%5C00000027%5C91014DJY.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C- y=r75g8/r75g8/x150y150g16/i425&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x	
he Fluorocarbon-Hydrogen Fluoride Industry:	

Phase 1, Part 2: Search of Standard RAD Sources

Results

ActionD=ZyDocument&Client=EPA&Index=1976+Thru+1980&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFie
xt%5C00000024%5C91016B1I.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-
y=r75g8/r75g8/x150y150g16/i425&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x

posure to Decomposition Products of Fluorocarbon Polymers:

efault.html"]

orofluorocarbons (CFCs) and Their Substitutes:

nd Fluorocarbons:

Phase 1, Part 2: Search of Standard RAD Sources

Results
d_brief_record.cfm?&FIELD1=SUBJECT&INPUT1=Ozone%20layer&TYPE1=EXACT&LOGIC1=AND&COLL=&SORT_TYPE=MTIC&item_count=30&item_accn=193577"]
r 3-5, 1991.
fm?&FIELD1=TITLE&INPUT1=INTERNATIONAL%20AND%20CFC%20AND%20HALON%20AND%20ALTERNATIVES%20AND%20CONFERENCE&TYPE1=ALL&LOGIC1=A
oam Product Manufacturing) and 326150 (Urethane and Other Foam Product (except Polystyrene) Manufacturing). Approximately 200 facilities reported under these primary NAICS codes, with releases reporte
oam insulation" as the industrial function category. One CDR submission lists "Foam blowing additive" as the industrial function category. 140 CDR submissions list "Propellant and blowing agents" as the indus
EPA Office of Water website were searched. No relevant results were found from these searches, but further research may be conducted as needed.

Phase 1, Part 2: Search of Standard RAD Sources

Results
ir-pollution/flexible-polyurethane-foam-production-and-fabrication-national"]
rce Emission Inventory Development: s/2015-08/documents/ii01_may2001.pdf"]
for Estimating Air Emissions from Plastic Products Manufacturing: s/2015-08/documents/ii11.pdf"]
rces/publications/assistance/sectors/web/pdf/resfibsn.pdf"]
rces/publications/assistance/sectors/web/pdf/rubplasn.pdf"]

Phase 1, Part 2: Search of Standard RAD Sources

	Results

l for information relevant to the scenario. No relevant information was found during these searches, but additional research may be conducted as needed.

ustry
ry

olvents:

23XKT.PDF?Dockey=91023XKT.PDF"]

Foam Manufacturing:

0TLS7.PDF?Dockey=2000TLS7.PDF"]

m-blowing-agents"]

s for the Foam and Refrigeration Sectors Until 2015 (Foam Projections):

s/2015-08/documents/foamemissionprofiles_part2.pdf"]

n Foams:

s/2015-07/documents/transitioning_to_low-gwp_alternatives_in_building_and_construction_foams.pdf"]

ant New Alternatives Policy Program:

s/2020-12/documents/epa-hq-oar-2003-0118-1710.pdf"]

Phase 1, Part 2: Search of Standard RAD Sources

	Results
gister/1991-11-07"]	
ool at the top of NIOSH's website. No relevant information was found from these searches, but further research may be conducted as needed.	

Phase 1, Part 2: Search of Standard RAD Sources

Results
Monograph No. 2: Methylene Chloride Background and National Experience with Reducing Risk:
publicdisplaydocumentpdf/?doclanguage=en&cote=ocde/gd(94)95"]
reenhouse Gases: CH4, N20, HFCs, PFCs and SF6:
publicdisplaydocumentpdf/?doclanguage=en&cote=com/env/epoc/daffe/cfa(99)110/final"]
ntifying Complementary Measures to Ensure the Maximum Realization of Benefits from the Liberalization of Trade in Environmental Goods and Services Case Study: Korea
f"]
r relevancy to this scenario. No relevant ESDs were found, but further investigation into the relevancy of particular information within these ESDs may be conducted as needed.

Phase 1, Part 2: Search of Standard RAD Sources

	Results
20: emissions reporting format, Section 4.3: Hydrofluorocarbon, perfluorocarbon and sulfur hexafluoride emissions: imate-change/services/climate-change/greenhouse-gas-emissions/facility-reporting/reporting/technical-guidance-2020/chapter-4.html"]	
ıtions: frequently asked questions: imate-change/services/canadian-environmental-protection-act-registry/ozone-depleting-substances-regulations-questions.html"]	
ompound definition: chapter 6: imate-change/services/canadian-environmental-protection-act-registry/publications/proposal-exclusion-volatile-organic-compound/chapter-6.html"]	
imate-change/services/air-pollution/issues/ozone-layer/depletion-impacts/substances.html"]	
ool at the top of Environment Canada's website. No relevant information was found, but further research may be conducted as needed.	

Phase 1, Part 2: Search of Standard RAD Sources

	Results
) Manufacturing	
vailable at: [HYPERLINK "https://www.bls.gov/oes/current/naics4_326100.htm"]	
ocuments number of sites and employees for 2019.	
ble for each NAICS code.	
. No relevant information was found, but further research may be conducted as needed.	

Phase 1, Part 2: Search of Standard RAD Sources

	Results
mic data for each NAICS code.	
lity/air-quality-planning/air-quality-rules-regulations/nc-tap-chemicals"]	
ction: /permits/insig/40_CFR_63_Subpart_6O_Flexible_Polyurethane_Foam_Production.pdf"] /permits/insig/40_CFR_63_Subpart_6O_Slabstock_Flexible_Polyurethane_Foam_Production.pdf"]	
", "Fluorocarbon Elastomers", "Insulation, Thermal", "Foams"	